

THE INSURANCE INDUSTRY'S ADAPTATION PRACTICE TO CLIMATE CHANGE

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ABSTRACT

Climate change increases the risks of natural hazards. The latest report of the United Nations Environment Programme (UNEP) released last October 2022 alleges the increasing climate change is contributed to by anthropogenic, that is, human-made activities. Its projected global temperature increase will severely affect everyone's living conditions and economy. As the most critical operation for managing and transferring climate risks and supporting climate action, the insurance industry is confronting the significant challenges arising from the foreseeable climate change in the next decades. Appropriate adaptation practices from the insurance industry are, thus, vital for its resilience and sustainability. However, there is a lack of an understanding of the climate actions the insurance industry is taking. More importantly, no systematic assessments of insurers' latest adaptation practices to better respond to the risks and opportunities arising from climate change exist. Therefore, this research aims to fill this gap by conducting a structured literature review and proposing a typology for differentiating the types of insurers' engagement in responding to climate change. Aiming to precisely identify the most influential literature, bibliometrics, a quantitative analysis of 927 articles on climate change and the insurance industry was conducted to determine the main topics, authors and associations, major publication countries and highly cited papers. Twenty-five articles were subsequently selected for the structured literature review. Three adaptation types: a climate change advocate, a risk management expert, and an innovative solution provider, were developed as the findings. The benefits and challenges encountered by each type of adaptation practice were discussed in depth to imply the future enhancement of the industry's role as a sustainable partner in battling the challenges of climate risks.

Keywords: insurance industry, climate change, bibliometrics, literature review.

INTRODUCTION

The concept of climate change, as defined by the United Nations, encompasses long-term alterations in both temperatures and weather patterns. Historical records indicate that global surface temperature measurements date back to the 19th century. These figures have steadily risen by approximately 1.1°C compared to the late 1800s (United Nations, n.d.). In October of 2022, a report from the United Nations Environment Programme (UNEP) indicated an increase in anthropogenic activities responsible for contributing to climate change. It projects a rise between 2.4°C and 2.6°C in temperatures by the end of this century, even under stringent compliance with adaptation policies (United Nations, 2022). This far surpasses some pre-determined goals like those outlined under guidelines at the Paris Agreement negotiations in 2015, which aimed to limit the average temperature increase to 1.5°C and 2.0°C before the century's end. Failure to attain the long-term objectives of the Paris Agreement may lead to a deterioration in living standards and ultimately result in an economic crisis on a global scale (Lenaerts et al., 2022).

The implications of climate change have far-reaching consequences, including human health (Filho et al., 2022), severe economic losses (Botzen & Van Den Bergh, 2008) and threats to the sustainability of the insurance industry (Mills, 2005). As the largest aggregator of such risks, accounting for 7% of the global economy, the insurance industry faces immense challenges adapting to changing environmental conditions (Deloitte, 2022). The World Health Organization warns that worsening climate conditions will increase deaths caused by malnutrition, diarrhoea, heat strokes and malaria between 2030 and 2050. This trend will negatively impact health insurance programmes by United States dollars (USD) two to four billion annually (Filho et al., 2022). Furthermore, catastrophes like floods, wildfires, droughts and earthquakes continue unabated alongside pandemics such as Coronavirus disease (Covid-19) outbreaks persisting indefinitely into our future (Stechemesser et al., 2015).

Along with the increasing risks, there are increasing opportunities in the insurance industry (Botzen & van den Bergh, 2009;

Mills, 2009). Not only proving evidence of potential profit that can be generated from offering insurance services, but the industry also has a crucial function in facilitating recovery for individuals and businesses affected by natural catastrophes (Botzen & Van Den Bergh, 2008; Thirawat et al., 2017). Therefore, the insurance industry must adapt to better respond to the risks and opportunities climate change represents for the industry.

According to the Principles for Sustainable Insurance (PSI) developed by the UNEP, the insurance industry must take proactive measures to mitigate environmental, social and governance (ESG) risks posed by climate change. Insurers can achieve this by performing roles that facilitate organisational transformation (United National Environmental Programme (ENEP) Finance Initiative, 2012). Table 1 illustrates these principles in detail. By adhering to PSI guidelines, insurance industry can expand their knowledge and understanding of sustainable practices that safeguard against potential ESG threats while leveraging opportunities for long-term growth.

Table 1: Principles for Sustainable Insurance

PRINCIPLES	
1	We will embed in our decision-making environmental, social and governance issues relevant to our insurance business.
2	We will work together with our clients and business partners to raise awareness of environmental, social and governance issues, manage risk and develop solutions.
3	We will work together with governments, regulators and other key stakeholders to promote widespread action across society on environmental, social and governance issues.
4	We will demonstrate accountability and transparency in regularly disclosing publicly our progress in implementing the principles.

Note. Adapted from <https://www.unepfi.org/insurance/insurance/the-principles/>. Copyright 2012 by UNEP Finance Initiative.

Against the backdrop of the catastrophic losses caused by climate change, the urgent need for industrial sustainability and the UNEP's initiative, insurance practitioners responded to climate changes variously (Mills, 2009). This literature review intends to assess the insurance industry's adaptation practices in response to climate change that are published in journal articles. The indicative features, effects and challenges of the identified adaptations in the literature are also analysed for implying future research and industrial practices.

LITERATURE REVIEW METHODS

This research deployed a combination of the quantitative and qualitative approaches of literature review for developing the typology for classifying insurance industries' responses to climate change. The quantitative approach is a scientific mapping method, namely Bibliometrics, used to assess the associations between the elements such as topics, concepts, fields, keywords, authors, affiliations, co-citations, journals, and countries of published articles (Aria & Cuccurullo, 2017; Zupic & Čater, 2015). This analysis clusters article connections bibliographically and presents the results by visualisations (Aria & Cuccurullo, 2017; Zupic & Čater, 2015). On the other hand, the qualitative approach compares the qualitative codes developed from reviewing the narratives in selected articles to present structured themes for in-depth interpretations (Zupic & Čater, 2015). Bibliometrics is dominantly descriptive, but a structured review is criticised as subjective (Zupic & Čater, 2015). Therefore, it is logical to apply Bibliometrics to confirm the research gap and identify the most influential literature and improve the efficiency of the qualitative review process. The subsequential structured review enhances the findings with in-depth interpretations.

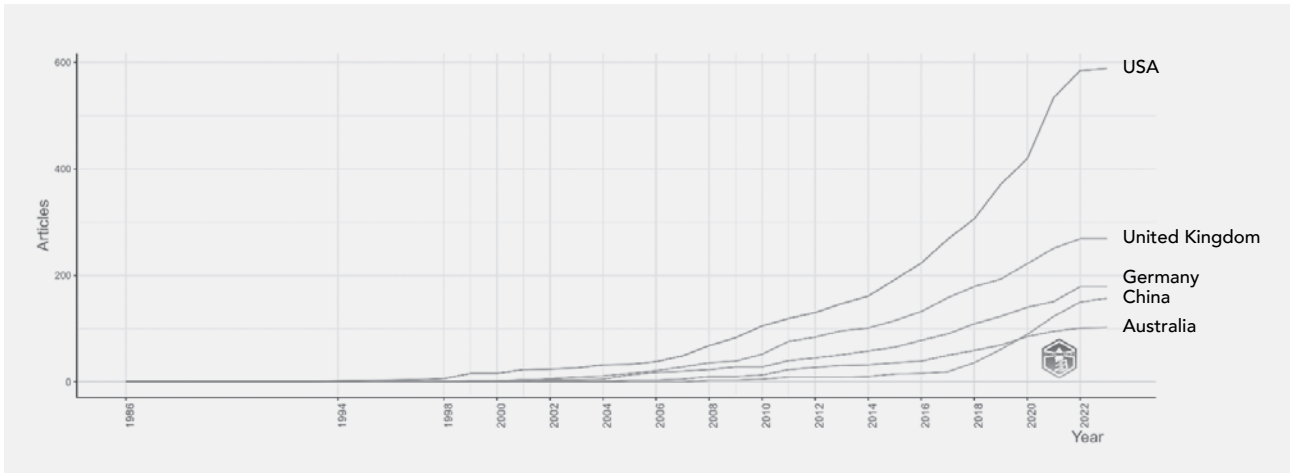
BIBLIOMETRICS AND FINDINGS

A total of 927 peer-reviewed journal articles were extracted from Scopus using "climate change*" and "insurance" as the search words. All information fields of the 927 articles were extracted in a BibTex file, which was analysed using Biblioshiny (an R-tool). The key results from the clustering analysis are presented in Figure 1 to Figure 4.

Figure 1 depicts the country-based accumulated publications over time. The research on insurance for climate change burgeoned from the late 1990s and grew significantly after 2000, especially among scholars from the United States of America (USA). The top five research productive countries, by descending order, include the USA, United Kingdom (UK), Germany, China and Australia. Figure 2 presents the cluster connections between the top ten authors, ten countries and twenty keywords presented in the 927 articles. Botzen and his European and USA co-authors (refer to Figure 3) were the most influential authors in publishing articles focused on insurance for climate change, with a special interest in flood insurance. Botsen, Aerts and Mills' articles have the highest score of citations compared to the others. The theme cooccurrence network (refer to Figure 4) demonstrates that the theme "Climate Change" is more closely connected to risk assessment, adaptation, flood, natural disaster, food, agriculture, and related themes. The top list of journals that published

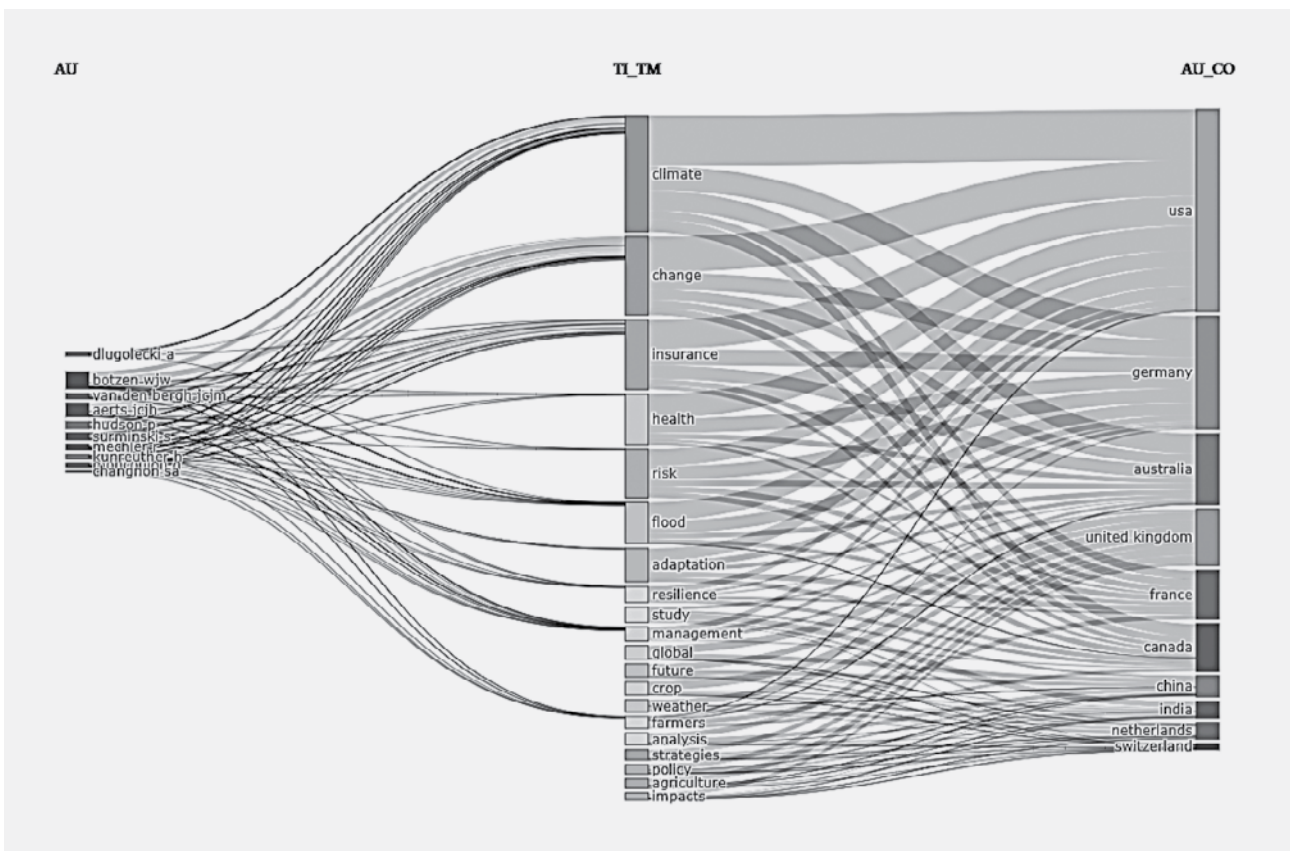
these articles include Geneva Papers on Risk and Insurance, Sustainability, International Journal of Climate Change Strategies, Climate Change, and Ecological Economics.

Figure 1: Country Production Over Time



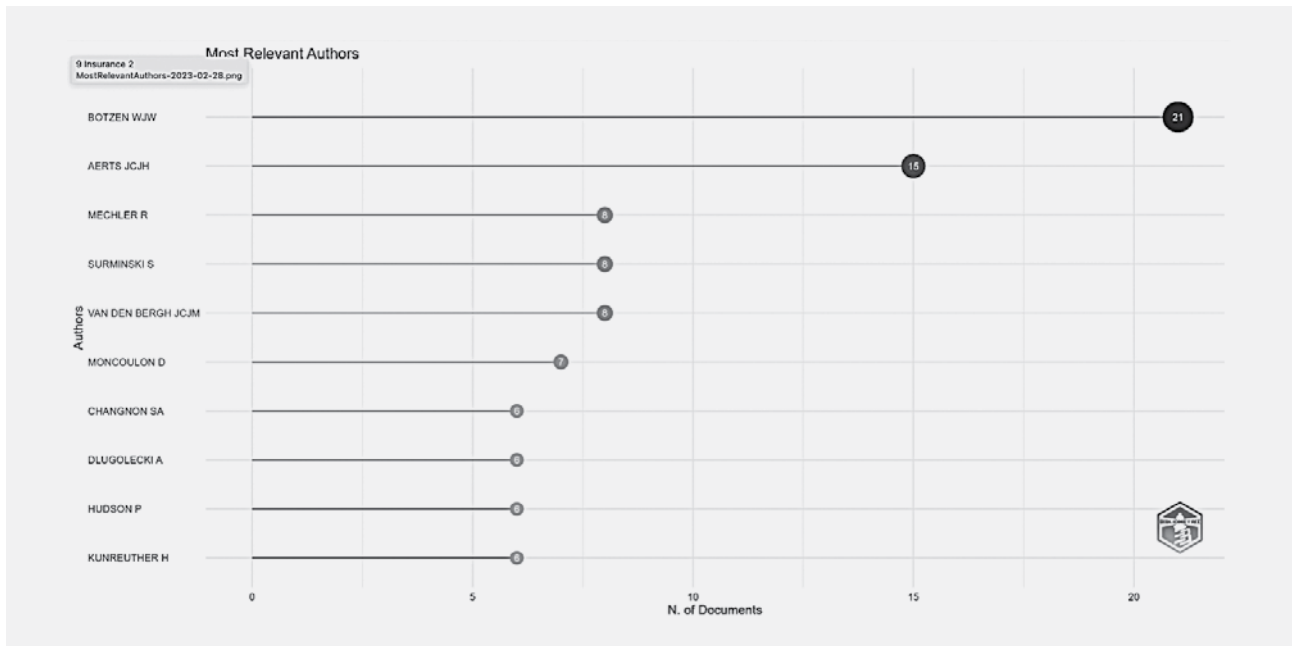
Note. Figure generated by Dai using Biblioshiny. Own work.

Figure 2: Three Field Plot



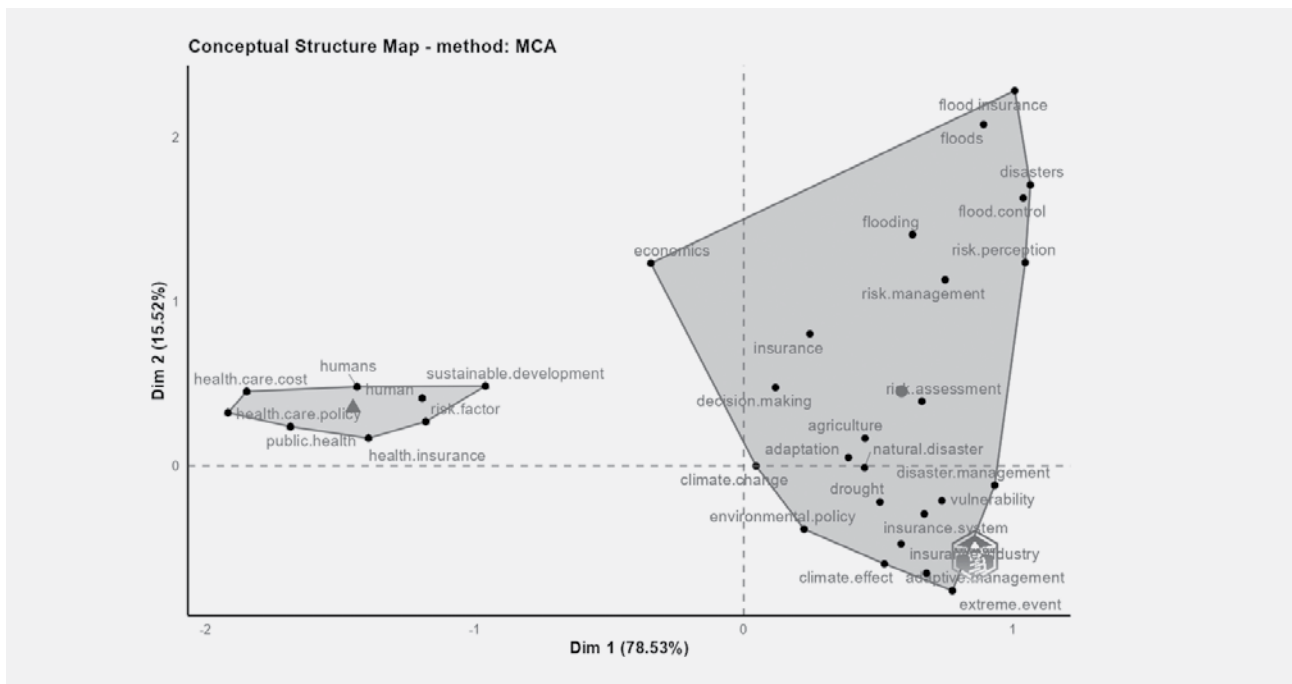
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Figure 3: Most Relevant Authors



Note. Figure generated by Dai using Biblioshiny. Own work.

Figure 4: Theme Cooccurrence Network



Note. Figure generated by Dai using Biblioshiny. Own work.

The findings from Bibliometrics clearly identified the leading authors, key themes and top journals for further investigation of articles for the structured review. It was relevant to select articles published after 2010 with a research focus on the insurance industry’s adaptation practices for climate change. Twenty-five articles were selected with the refined criteria, which were deemed highly representative sources for review.

The structured review utilised the ten categories of insurer climate activities published in Mills’ (2009) study as the initial codes (refer to Table 2) and added new codes while reviewing the later articles. Twelve codes were finalised and further categorised based on insurers’ attitudes and engagement. Code 1, understanding the climate change problem, was not discovered. The plausible explanation is that such activity may not be necessary after more than a decade of promotion of climate change. As presented in Tables 3, 4 and 5, three new codes including incorporating ESG agenda, tailoring risk measurements for

enterprise clients, and repackaging insurance products were added. After several iterations of the code refining process, the three adaptation types were determined: a climate change advocate, a risk management expert, and an innovative solution provider. The following section discusses the key features, benefits and challenges summarised from the reviewing articles.

Table 2: Insurer Climate Activities Before 2009

INSURER CLIMATE ACTIVITIES BEFORE 2009	
1	Understanding the climate change problem
2	Promoting loss prevention
3	Aligning terms and conditions with risk-reducing behaviour
4	Crafting innovative insurance products and services
5	Offering carbon risk management and carbon reduction services
6	Financing climate-protection improvements
7	Investment in climate change solutions
8	Building awareness and participating in public policy
9	Leading by example
10	Climate risk disclosure

Note. Reprinted from "A Global Review of Insurance Industry Responses to Climate Change" by E. Mills, 2009, Geneva Papers on Risk & Insurance, 34, p.331. Copyright 2009 by The International Association for the Study of Insurance Economics.

STRUCTURED REVIEW

As implied in the Bibliometrics results, climate insurance is clustered closely with adaption. Kahn (2021) challenged the difficulties in mitigating the effects of climate change, which Kahn believes is a passive reaction and less effective. On the other hand, Kahn (2021) strongly recommended adaptation as a better way of involving human engagement, which is more proactive. Therefore, this literature review focuses on insurers' adaptation practices to build their resilience and longevity. The three categories of the adaptation practice were reviewed and evaluated in the following subsections.

Climate Change Advocate

The authors define that an advocate is not just a passive supporter but an active agent of change who publicly champions and recommends a cause or policy. They are willing to take clear and bold actions to promote positive advancement towards their goals. In the context of climate change, it has become increasingly crucial for industries like insurance that stand at the front line of environmental impact to lead by example as advocates for sustainability (Debus & Himmelrath, 2022). Table 3 summarises the codes of the insurers' climate activities, key practices, and associated peer-reviewed articles for climate change advocates.

Table 3: Climate Change Advocate – Codes Summarised from the Reviewed Literature

INSURER CLIMATE ACTIVITIES	KEY PRACTICES	ARTICLES
Building awareness and participating in public policy	Including climate change as a topic in debates in parliament	Debus & Himmelrath (2022)
	Compelling insurers to share their climate risk information with the government and policymakers	Surminski et al. (2022); Lucas et al. (2021)
	Increasing public awareness about such action	
Promoting loss prevention	Promoting agricultural insurance products in mitigating climate losses	Wang et al. (2022)
	Introducing a crop insurance policy to mitigate losses in case of natural disasters	Wang et al. (2021)
Leading by example	Integrating adaptation measures in business operations	Gatzert et al. (2020)
	Changing processes and decision-making frameworks and adopting responsible management approaches	Sato & Seki (2010)

INSURER CLIMATE ACTIVITIES	KEY PRACTICES	ARTICLES
Investment in climate change solutions	Investing in companies that are aligned with the insurance company's ESG principles	Mittal et al. (2021); Braun et al. (2019)
	Increasing business development increases the company's carbon dioxide (CO ₂) emissions	Isaac & Acheampong (2021)
Climate risk disclosure	Providing comprehensive climate risk knowledge to assist enterprise clients and householders in making the best informative decision	Surminski et al. (2022); Stechemesser et al. (2015); Lucas et al. (2021)
New code: Incorporating ESG agenda	Adapting ESG agendas in support of the UN's SDGs	Stricker et al. (2022)
	Including ESG agenda as part of the insurance company's branding and marketing strategy	Brogi et al. (2022); Kushwah & Mathur (2022)

Note. Table generated by Mendoza. Own work.

The top five codes were kept from Mills' (2009) study, which suggests that engaging in governmental policies (Debus & Himmelrath, 2022; Jiang et al., 2023; Surminski et al., 2022), advertising on loss prevention (Wang et al., 2022; Wang et al., 2021), promoting exemplars (Gatzert et al., 2020; Sato & Seki, 2010), investments in solutions and disclosing climate risks (Braun et al., 2019; Isaac & Acheampong, 2021; Mittal et al., 2021) are still prevalent practice for the insurance industry. A new code, incorporating the ESG agenda (Brogi et al., 2022; Kushwah & Mathur, 2022; Stricker et al., 2022), emerged from the later research. The United Nations (UN) played a critical role in initiating and influencing ESG development (Korcheva, 2022).

Despite a slow transformation, the insurance industry has recently adopted ESG agendas supporting the UN's sustainable development goals (SDGs) (Stricker et al., 2022). This change has been met with hesitation due to concerns about additional expenses associated with supporting sustainability initiatives. However, recent studies such as those conducted by Brogi et al. (2022) and Kushwah & Mathur (2022) have demonstrated that an ESG agenda positively impacts insurance industry. These studies highlight how the insurance companies with clear and well-defined ESG agendas are perceived as more trustworthy by the public than those without such policies. Moreover, using an ESG agenda as part of the insurance company's brand and marketing strategies can attract new customers who value reliability and security for themselves and their beneficiaries (Kushwah & Mathur, 2022).

Mittal et al. (2021) highlighted that many insurance companies incorporate ESG factors into their investment decision-making processes. These insurers choose to invest in firms that align with ESG principles and actively advocate for climate change mitigation efforts. Such a mutually beneficial relationship allows them to advance sustainable practices while ensuring long-term profitability simultaneously. However, Braun et al. (2019) challenged this assertion and suggested no definitive evidence linking an insurer's greenhouse gas emissions contribution or reputation with its investment portfolio's overall performance concerning sustainability metrics. Moreover, Isaac and Acheampong (2021) revealed a concerning correlation between development in the insurance industry and CO₂ emissions. According to their findings, every 10% increase in the insurance industry results in a 2% rise in CO₂ emissions (Isaac & Acheampong, 2021). This statistic is alarming, given that CO₂ is known as one of the primary greenhouse gases contributing to global warming.

Surminski et al. (2022) critique that some insurers hesitate to disclose climate risk data on the barriers to effective adaptation to climate change. A collaboration between parties with transparent sharing of climate risk knowledge needs to be established. Climatic information rewards programmes should be encouraged. Stechemesser et al. (2015) delve into climate risk information and its relationship with financial growth in greater depth. They provide compelling evidence that acquiring and utilising this type of information can have long-term benefits that far outweigh any initial costs organisations incur (Stechemesser et al., 2015).

Conversely, Lucas et al.'s. (2021) recent research highlights a possible need for improvement in realising these benefits. Even if individuals can access climate risk information, they may still need action, such as purchasing insurance coverage. According to the authors' findings, willingness-to-pay (WTP) is a crucial factor driving consumer behaviour when purchasing insurance, highlighting an area where insurers might focus their efforts if they hope to better capitalise on the value of climate risk data. Albeit contrasting, these two articles emphasise the importance of providing climate risk information and understanding how people will react to it to ensure the benefits are realised.

Furthermore, the reviewed articles implied that insurance companies hold a view that policymakers and regulators are powerful influencers in promoting insurance policies for climate change (Debus & Himmelrath, 2022; Jiang et al., 2023; Surminski et al., 2022). As a result, insurance companies lobbying policymakers will remain for the long term. Nevertheless, policymakers and regulators are the supervision authority that monitor insurance companies' adherence to environmental standards, enforce greater transparency and ensure the insurance industry's accountability.

Risk Management Expert

The insurance industry is critical in managing risks, particularly climate change-related ones. It is the largest aggregator of such risks (Stechemesser et al., 2015; Surminski et al., 2022). It possesses a vast wealth of information on mitigating them through its comprehensive data collection from each policy and claim (Zulfiqar et al., 2020). Thus, the industry is uniquely positioned to leverage this knowledge towards developing enterprise risk management strategies that can effectively combat climate-induced perils (Botzen & van den Bergh, 2009). Treating climate change as an enterprise risk management issue could give insurers a holistic approach to identifying, assessing and mitigating risks. Therefore, the three codes of risk management activities remain in insurers' latest practice, and no code was removed from the ones specified in Mills' (2009) study. Engaging in enterprise risk management is a new type of activities emerged from the late studies (Stechemesser et al., 2015; Surminski et al., 2022).

Table 4: Risk Management Expert – Codes Summarised from the Reviewed Literature

INSURER CLIMATE ACTIVITIES	KEY PRACTICES	ARTICLES
Aligning terms and conditions with risk-reducing behaviour	Collecting data from underwritten policies, filed and paid claims for effective risk management	Zulfiqar et al. (2020) Ivanovna et al. (2018)
	Including management accounting as a source of information for the insurance company's risk management	
Financing climate-protection improvements	Developing a loss-sharing disaster financing scheme for flood risks	Jongman et al. (2014)
	Risk Sharing Arrangements for public sector flood risk	Unterberger et al. (2019)
	Developing risk insurance facility for disaster risk reduction	Thirawat et al., 2017)
Offering carbon risk management and carbon reduction services	agricultural insurance incorporating favourable coverage on the adoption of low-carbon technologies	Jiang et al. (2023)
New code: Tailoring risk measurements for enterprise risk management	Providing comprehensive risk knowledge to assist Enterprise clients in making the best informative decision	Surminski et al. (2022)
	using seven categories of adaptation measures associated with three dynamic capability dimensions of climate change adaptation	Stechemesser et al. (2015)

Note. Table generated by Mendoza. Own work.

To truly establish itself as an expert in risk management, however, the insurance industry must proactively align its terms and conditions with climate risk reductions. Zulfiqar et al. (2020) and Ivanovna et al. (2018) investigated the collection of underwritten policies, paid claims and management accounting information for effective risk policy design. Such activity may be transformed from that defined in Mills (2009) study, which is similar to the category. The second essential role, financing climate-protection improvements, evolved to developing risk-sharing arrangements or schemes for mitigating disaster risks at a national or international level. All these risk-sharing arrangements or schemes were proven to have long-term benefits but similarly increasing costs for the insurance clients (Jongman et al., 2014; Thirawat et al., 2017; Unterberger et al., 2019). Jiang et al's. (2023) study is a typical example of carbon reduction services provided to Chinese farmers. In a similar vein, the above four studies alleged the necessity of government support to promote their investigation of insurance services and schemes. An extension of risk management schemes is the insurers' focus to include enterprise clients, due to the significant role of these clients in climate change, with more emphasis on providing extensive risk knowledge and developing adaptation measurements for enterprise clients (Stechemesser et al., 2015; Surminski et al., 2022).

Risk management expertise remains the primary adaptation role for insurance companies. The findings suggest that insurers or their employed researchers endeavour to develop insurance products to cover the growing climate risks and actively engage in lobbying their governments for support. Fortunately, in recent years, various industries have made significant advancements towards finding ways to address this urgent global concern. Among these players is the insurance industry which has taken proactive measures to develop innovative products to help bridge the widening protection gap caused by increasingly unpredictable and extreme weather conditions (Stricker et al., 2022).

Innovative Solutions Provider

Given the enormity of the issue at hand, namely climate change, it has become imperative for a pivotal player to emerge as a practical solutions provider. By creating insurance policies that better assess and address climate-related hazards, the insurance industry was found in playing a crucial role to help individuals and businesses become more resilient to the challenges brought forth by climate change (Stricker et al., 2022). Moreover, as supporters of mitigative and adaptive actions towards climate change, insurance companies can shift their focus from transactional engagements to more consultative approaches (Stricker et al., 2022). Table 5 summarises the main activities and key practices that insurers profiled as innovative solutions providers adopted.

Table 5: Innovative Solutions Provider – Codes Summarised from the Reviewed Literature

INSURER CLIMATE ACTIVITIES	KEY PRACTICES	ARTICLES
Crafting innovative insurance products and services	Developing innovative products	Stricker et al. (2022)
	Reintroducing crop insurance policy to protect farmers	
	Purchasing parametric insurance instead of the traditional indemnity-based insurance	Miquelluti et al. (2022)
New code: Repackaging insurance products and services with flexible premium or subsidy schemes	Incorporating artificial intelligence and machine learning into risk management models	Bakošová (2022)
	Including a subsidy system in the natural disaster coverage insurance model.	
	Giving tax breaks for properties in high-risk regions and lower premium rates for properties in lower-risk regions	Kalfin et al. (2022)
	Repackaging property insurance with risk-based pricing	Standohar-Alfano et al. (2017)

Note. Table generated by Mendoza. Own work.

Crop insurance is a critical tool that can safeguard farmers’ income when their crops are affected by natural disasters. Developed in the 1930s, this protective mechanism has been proven to be highly effective in protecting agricultural incomes, according to an article authored by Miquelluti et al. (2022). Although available for several decades, crop insurance’s market size will grow and reach USD 61.30 billion by 2030. The increasing of the Earth’s temperature could contribute significantly towards the growth of the agricultural insurance industry over time up until 2030. However, recent research by Wang et al. (2021) highlights an issue with the current crop insurance system that may have unforeseen consequences. Some farmers must be more competent to take proactive measures against climate change and other environmental risks and not overly feel secure in their coverage under existing crop insurance policies. Ultimately, while it remains essential for policymakers and stakeholders to continue to provide crop insurance as a critical means of disaster recovery for farmers, the research shows that additional measures may be needed to incentivise proactive climate mitigation measures among farmers.

Miquelluti et al. (2022) provided an alternative solution to address weather-related issues presented with parametric or index-based insurance. The paper further suggests that insurers can offer a non-traditional indemnity policy based on a weather index to protect policyholders against losses caused by natural calamities such as floods and hurricanes. This innovative approach entails paying out a pre-determined amount triggered solely by event magnitude rather than assessing actual losses, which traditional indemnity policies do. The benefit of this product is how claims are settled. Payouts are faster since it does not need a damage inspection Miquelluti et al., 2022).

Similarly, a study by Standohar-Alfano et al. (2017) explored climate change’s impact on property insurance availability and affordability in the USA, focusing on wind-related property insurance in Florida. The paper identified the effects of climate change on property values as a critical concern for the industry. In response to these challenges, the insurance industry has implemented strategies such as risk-based pricing, limiting coverage in high-risk areas, and introducing new coverage options, such as parametric insurance (Standohar-Alfano et al., 2017).

Another alternative insurance solution that can be crucial in adapting to climate change is packaging the disaster insurance product with a subsidy programme granted by the government (Jiang et al., 2023; Kalfin et al., 2022). Considering Indonesia’s unique geographical conditions, Kalfin et al. (2022) conducted an extensive study exploring how natural disaster insurance could be instrumental in supporting the country’s resilience against catastrophic events caused by extreme weather patterns and other environmental factors. The research highlighted the importance of integrating an assistance system into the insurance model the government would grant, considering various pricing mechanisms based on the potential severity of natural disasters in a specific area. Properties located in high-risk zones would receive tax breaks from the government on their insurance premiums, while those in low-risk regions would benefit from reduced subsidies. This approach aims to promote fairness across social classes and incentivises insurers and policyholders amid mounting fears about the impacts of climate change (Kalfin et al., 2022).

Moreover, the paper by Bakošová (2022) suggests that incorporating advanced technologies such as Artificial Intelligence and Machine Learning into existing risk management models can provide more accurate risk assessments by analysing large volumes of data, leading to better pricing, underwriting decisions and more efficient claims settlements.

All the above findings highlight that the insurance industry’s response to climate change has been varied and nuanced, with different strategies implemented in other contexts.

CONCLUSION

Over the years, the insurance industry has significantly changed how it responds to climate change, which has been thoroughly analysed in various articles. What stands out is the crucial role policymakers and regulators play in shaping the future course of this industry. They have an enormous responsibility for working alongside climate change advocates to create policies that ensure insurers and their government adopt measures for climate change adaptation. In addition, collaboration among policymakers and regulators and risk management experts is imperative for effective risk mitigation planning that benefits individuals and businesses. Furthermore, working closely with solutions providers becomes necessary to develop innovative products within budgetary constraints, a critical component when attempting widespread disaster recovery support post-catastrophe events such as hurricanes or earthquakes.

To summarise, while these responses bring positive developments within the insurance industry's ecosystem, it will only realise its full potential through the engagement of policymakers and regulators in promoting climate change adaptation measures and working closely with risk management experts and solutions providers to develop innovative products. This collaborative effort is vital to ensure that the insurance industry is equipped to respond efficiently and effectively to climate change impacts while fostering sustainable development for all.

The research contributes to the literature with the typology of insurers' adaptations to climate change. The focus is constrained to the insurance industry's adaptation practices studied and published in the journal articles reviewed. Such a constraint and the scope of the article selection might limit the trustworthiness of the research findings. However, the limitations were mitigated by identifying the best representable articles from the bibliometrics analysis and careful manual scrutinisation of the articles.

There is a concern about the jurisdiction's influence on the insurance industry's adaptation practices (i.e., different countries have different guidelines, legislation, and political agendas to favour or limit adaptations to better respond to climate change). Since the research findings were scoped to be silent in this regard, future research could further investigate country differences in relation to how the political, legislative, and economic conditions impact their insurance industry's adaptation practice.

Furthermore, this research did not conduct a stakeholder analysis for a more subtle understanding of each different stakeholder's role in this research context. It would be recommended in future to conduct primary research in order to investigate how the insurance industry's adaptations impact or may be impacted by local or central government, brokers/agents, customers, and local communities in addition to insurance companies.

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